SEND COMPLETE DISCLOSURE DIRECT TO:

CORPORATE PATENTS AND LICENSING
Loc. CO. Bldg. C1, M/S A126

INVENTION DISCLOSURE

THIS INVENTION DISCLOSURE IS MADE PURSUANT TO MY/OUR INVENTION AGREEMENT WITH HUGHES AIRCRAFT COMPANY

1. TITLE OF INVENTION

DirecPC Gear Shifting

2. INVENTOR(S)

NAME	PAYROLL NO.	SOURCE CODE	LOC	BLDG	M/S	PHONE	DEPARTMENT HEAD
Doug Dillon				LFF		301-212-7878	John Kenyon

3. PROOF OF CONCEPTION

A. BY WHOM WAS FIRST DESCRIPTION WRITTEN OR DRAWING MADE? Doug Dillon	DATE [redacted]	TIME SPENT 1 hour	ACCT. CHARGED 11906	LOCATION OF FIRST DESCRIPTION/DRAWING Electronic Media in the PC
B. TO WHOM WAS INVENTION FIRST DISCLOSED? Harvey Lindenbaum	DATE [redacted]			

4. REDUCTION TO PRACTICE

A. WAS A DEVICE EMBODYING THE INVENTION CONSTRUCTED AND TESTED OR THE PROCESS PRACTICED?	YES ( ) NO (X)	BY WHOM	DATE STARTED	DATE COMPLETED	TIME SPENT
B. ACCT. CHARGED - TIME	ACCT. CHARGED - MATERIAL			PRESENT LOCATION OF DEVICE	

C. PRESENT LOCATION OF DOCUMENTS (DATE SIGNED AND WITNESSED), INCLUDING PHOTOS, DWGS, AND DATA SHEETS SHOWING REDUCTION TO PRACTICE. Electronic Media in Doug Dillons PC

NOTE: ALL EVIDENCE OF CONCEPTION (FIRST DRAWING AND FIRST WRITTEN DESCRIPTION) AND EVIDENCE OF REDUCTION TO PRACTICE (DEVICE EMBODYING THE INVENTION AND TEST DATA) MUST BE RETAINED.

5. RELATION TO GOVERNMENT CONTRACT

A. DOES THIS INVENTION RELATE TO WORK PERFORMED UNDER A GOVERNMENT CONTRACT?	YES ( ) NO (X)	CONTRACT NUMBER AND TITLE N/A
B. IS INVENTION BEING USED ON A GOVERNMENT CONTRACT?	YES ( ) NO (X)	CONTRACT NUMBER AND TITLE N/A

6. RELATED DOCUMENTS AND DISCLOSURE (BY YOU OR BY ANOTHER). PLEASE ATTACH COPY.

A. IS THERE A PUBLICATION OR PUBLIC PRESENTATION RELATED TO THE INVENTION?	YES ( ) NO (X)	DATE N/A	IDENTIFY N/A
B. ARE THERE ANY RELATED INVENTION DISCLOSURES OR PATENT APPLICATIONS?	YES ( ) NO ( )	DATE	IDENTIFY PD NO. ETC.
C. ARE THERE ANY PROPOSALS OR REPORTS OR OTHER DOCUMENTS RELATING TO THIS INVENTION?	YES (X) NO ( )	DATE [redacted]	IDENTIFY Data Sheet - DirecPC Gear Shifting
D. HAS THE INVENTION BEEN USED, DISCUSSED, DEMONSTRATED OR OTHERWISE DISCLOSED OUTSIDE THE COMPANY (SUCH AS TO A VENDOR OR CUSTOMER)?	YES ( ) NO (X)	DATE N/A	TO/FOR WHOM (COMPANY/PERSON) N/A

7. SALE

A. HAS PRODUCT EMBODYING INVENTION OR MADE BY INVENTION BEEN PROPOSED, SOLD, OR OFFERED FOR SALE?	YES ( ) NO (X)	ORDER NO. N/A	ORDER DATE N/A	DELIVERY DATE N/A	DATE OFFERED OR PROPOSED N/A
B. IS PRODUCT EMBODYING INVENTION OR MADE BY INVENTION IN A DELIVERABLE ITEM?	YES ( ) NO (X)	DELIVERY DATE N/A			

N96055
PATENT DOCKET NO.

HUGHES PROPRIETARY

THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION, AND EXCEPT WITH WRITTEN PERMISSION OF HUGHES AIRCRAFT COMPANY, SUCH INFORMATION SHALL NOT BE PUBLISHED, OR DISCLOSED TO OTHERS, OR USED FOR ANY PURPOSE, AND THE DOCUMENT SHALL NOT BE DUPLICATED IN WHOLE OR IN PART. THIS LEGEND SHALL BE APPLIED TO ALL DOCUMENTS CONTAINING THIS INFORMATION.

Doug Dillon
SIGNATURE INVENTOR

[redacted]
DATE

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1. TITLE OF INVENTION SHEET 1 OF

DirecPC Gear Shifting

2. INVENTOR(S)

NAME	PAYROLL NO.	SOURCE CODE	LOC	BLDG	MS	PHONE	DEPARTMENT HEAD
Doug Dillon				LFF		301-212-7876	John Kenyon

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HUGHES PROPRIETARY

PATENT DOCKET NO. PD-N96055

[redacted] SIGNATURE INVENTOR

[redacted] DATE

DirecPC Gear-Shifting

[redacted] Data Sheet

DirecPC Gear-Shifting increases the usable Turbo-Internet capacity of DirecPC systems with multiple transponders on the same satellite. DirecPC Gear-Shifting runs one transponder at the existing 11.79 Mbit/sec rate and runs the other transponders at 23.58 Mbits/sec rate. A typical user may run on either class of transponder. Users which are either experiencing a rain fade or which are located on the fringe of the satellite's coverage operate only on the 11.79 Mbit/sec rate. DirecPC Gear shifting dynamically moves users from one transponder to another as required to meet with accomodate changing wearther conditions and to balance the load across transponder.

The DirecPC satellite channel link budget is designed to provide acceptable reception for the worst-case receiver operating in a rain fade in the worst place in the continental US with worst case adjacent satellite interference. As a result, a typical site is measured to have 4 or 5 dB of blue-sky margin enabling operation at 23.58 Mbits/sec under blue-sky conditions.

The table below provides the relative number of online subscribers per transponder DirecPC Gear Shifting. The table below is based on the assumption than no more than one transponder is needed to run at the lower bit rate.

Number Of Transponders		Total	Total	Relative	
11.79	23.58	Mbits/sec	MBits/sec	Number	
Mbit/sec	MBits/sec	W/ Gear Shift	W/Out	Of Subs	
1	0	11.79	11.79	1	
1	1	35.37	23.58	1.5	
1	2	58.95	35.37	1.666667	
1	3	82.53	47.16	1.75	
1	4	106.11	58.95	1.8	

DirecPC Gear shifting operates as follows:

1. The DirecPC NOC periodically broadcasts on each of the transponders the frequency, bit rate and weighted loading of each transponder. Low-speed transponder loading is weighted to show the transponder somewhat more heavingly loaded than it really is. Broadcast services are located on a low-speed transponder and offline DirecPC receivers tune to this transponder when not "online".
2. As part of going online (dialing in), the DirecPC receiver tunes to the transponder advertized by the NOC as least loaded and notifies the NOC which transponder it is on. The NOC routes return traffic via that transponder. As users go online and offline the traffic load is naturally balanced across transponders leaving extra capacity on the low-speed transponders.
3. Steps 4 and 5 below maintain load-balancing across transponders while dynamically shifting receiver Pcs to the appropriate speed transponder.
4. The DirecPC receiver monitors its receive status and switches to the least-loaded, low-speed transponder should the receiver be operating at high speed and should the estimated Eb/No below the "shift-low" threshold. On shifting to another transponder, the DirecPC receiver notifies the NOC of this shift and the NOC routes traffic through the new transponder. By default this threshold is .5 dB above the modem operating point. The shift-low threshold is periodically broadcast on all transponders.
5. The DirecPC receiver monitors its receive status and switches to the least-loaded, high-speed transponder should the estimated Eb/No rise above a "shift-high" threshold and should the receiver be operating at low-speed and should the weighted load of the candidate transponder be lower than the weighted load of the low-speed transponder. By default the "shift-high" threshold is 4.5 dB above the modem operating point. The "shift-high" threshold is periodically broadcast on all transponders.
6. The NOC maintains statistics of the relative loading of the various transponders and can adjust the mix of low and high-speed transponders accordingly, for example on a monthly basis.